

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/047326 A1

(51) International Patent Classification⁷: **H04B 1/707**

Alfredo [IT/IT]; Telecom Italia S.p.A., Via G. Reiss Romoli, 274, I-10148 Torino (IT).

(21) International Application Number:
PCT/EP2002/012813

(74) Agents: **GIANNESI, Pier, Giovanni et al.**; Pirelli S.p.A., Viale Sarca 222, I-20126 Milano (IT).

(22) International Filing Date:
15 November 2002 (15.11.2002)

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(71) Applicants (*for all designated States except US*): **TELECOM ITALIA S.P.A.** [IT/IT]; Piazza degli Affari, 2, I-20123 Milano (IT). **STMICROELECTRONICS S.R.L.** [IT/IT]; Via C. Olivetti, 2, I-20041 Agrate Brianza (MI) (IT).

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

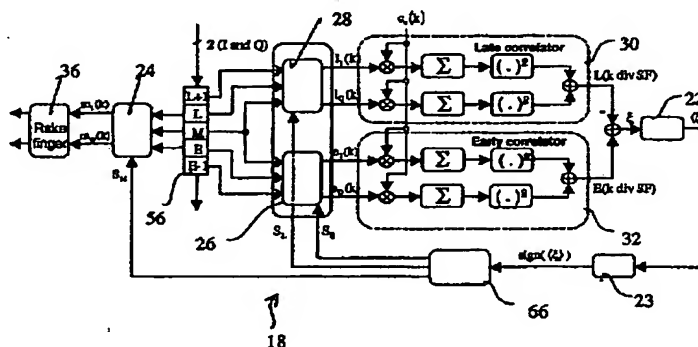
(75) Inventors/Applicants (*for US only*): **ETTORRE, Donato** [IT/IT]; Telecom Italia S.p.A., Via G. Reiss Romoli, 274, I-10148 Torino (IT). **GRAZIANO, Maurizio** [IT/IT]; Telecom Italia S.p.A., Via G. Reiss Romoli, 274, I-10148 Torino (IT). **MELIS, Bruno** [IT/IT]; Telecom Italia S.p.A., Via G. Reiss Romoli, 274, I-10148 Torino (IT). **FINOTELLO, Andrea** [IT/IT]; Telecom Italia S.p.A., Via G. Reiss Romoli, 274, I-10148 Torino (IT). **RUSCITTO,**

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND DEVICE FOR FINE SYNCHRONIZATION OF A DIGITAL TELECOMMUNICATION RECEIVER



(57) Abstract: A method for the synchronization of a digital telecommunication receiver comprises the steps of: - storing a plurality of consecutive samples E-I, E, M, L, L+1 of an incoming spread spectrum signal in a delay line 56; - determining by interpolation between consecutive samples of the incoming spread spectrum signal, by means of a first digitally controlled interpolator 26, an interpolated early sample (e) anticipating an optimal sampling time instant; - determining by interpolation between consecutive samples of the incoming spread spectrum signal, by means of a second digitally controlled interpolator 24, an interpolated middle sample (m) corresponding to the optimal sampling time instant; - determining by interpolation between consecutive samples of the incoming spread spectrum signal, by means of a third digitally controlled interpolator 28, an interpolated late sample (l) delayed with respect to the optimal sampling time instant; - calculating an error signal ξ as the difference between the energy of the symbols computed from the interpolated early sample (e) and the interpolated late (l) sample; - extracting the sign of the error signal ξ - accumulating the sign of the error signal ξ for the generation of control signals S_e , S_m , S_l for controlling the interpolation phases of the digitally controlled interpolators used for determining the interpolated early (e), middle (m) and late (l) samples. The accumulated value has a positive saturation value of +4 and a negative saturation value of -4.